Instrumentation for joint test assemblies

The move to strategic deterrence, starting with the Polaris submarine-launched ballistic missile in 1960, ushered in the need for ways to score weapon performance beyond simply observing an explosion.

Most nuclear weapons programs now use telemetry systems to transmit to a ground station data from tests carried out in a realistic environment.

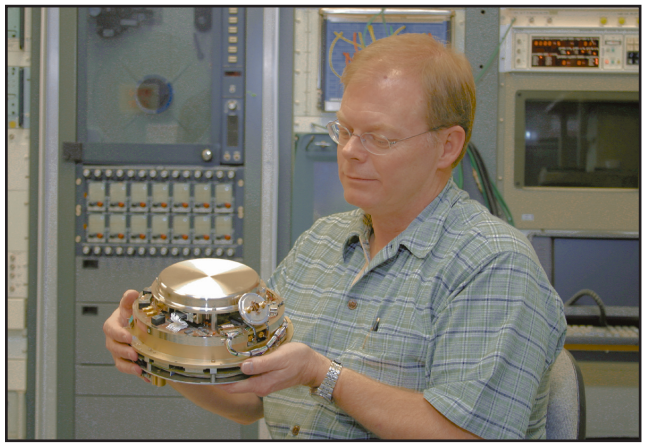
B-83 joint test assembly drop test

Critical capability

Test data obtained with telemetry instrumentation is used for the annual certification to the White House of the stockpile's safety, security and reliability. Instrumentation packages are fielded on test flights sponsored jointly by the Department of Energy, which is responsible for creating the weapon's explosive package and supporting hardware, and the Department of Defense, which is responsible for delivering the weapon via a missile or plane. These "joint test assemblies" measure dynamic, explosive, diagnostic, and subcomponent data and transmit the information to ground stations for display and analysis.

Instrumentation expertise

Sandia/California has designed telemetry systems for many years and since 1994 has overseen design of joint test assembly instrumentation systems for the entire stockpile. Telemetry experts at the California site also reduce data from flight tests of weapons designed with Lawrence Livermore National Laboratory. (Sandia/New Mexico handles data reduction for weapons systems designed with Los Alamos National Laboratory.) In addition to joint test assemblies, Sandia/California also designs and builds telemetry instrumentation for weapon development programs to obtain measurements needed by weapons systems groups.



A telemetry engineer with the W76-1 joint test subassembly

NNSA

SAND2003-8176P
February 25, 2004

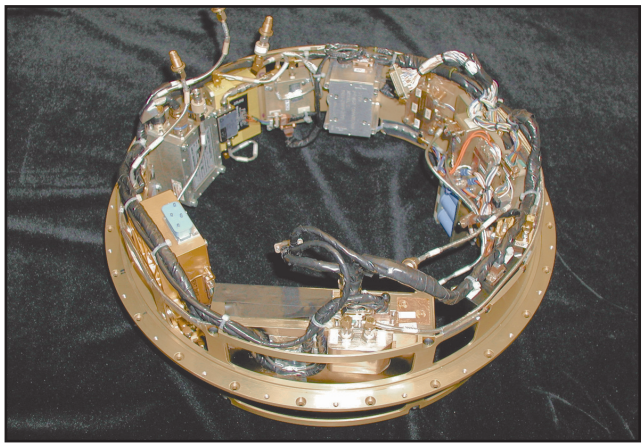
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

AY5360

Weapons programs that the telemetry instrumentation group supports include:

- W62 Minuteman III
- W76 Trident II
- W78 Minuteman III
- W80 cruise missiles (air- and sub-launched)
- W87 Peacekeeper
- W88 Trident II
- B83
- B61



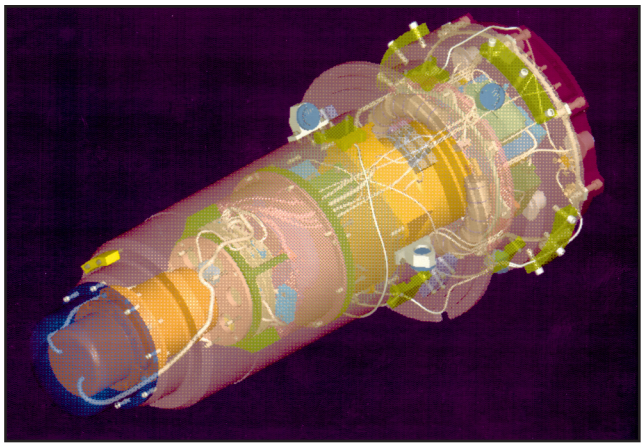
Telemetry assembly for a reentry vehicle instrumentation development flight test unit

Instrumentation systems are re-designed when suppliers discontinue components that were incorporated at the weapon's inception, or new instrumentation capability is required. Newly developed instrumentation is applicable to multiple warhead programs. Designers face several constraints; components must be packed in tight spaces, and the electrical configuration and mass properties cannot be changed.

Test measurements must be extremely reliable. With fewer flight tests anticipated, joint test assemblies are challenged to collect more information per flight, including diagnostic and "end-event" data that must be transmitted in a short time window of hundreds of microseconds.

Future enhancements

To face these challenges, the telemetry instrumentation group envisions eventually embedding small, smart, distributed instrumentation modules, some of which may be wireless. The system will adapt under changing conditions and via on-board intelligence, maximizing the amount of useful information transmitted. This expertise with wireless technologies and with rugged, high-performance instrumentation systems has contributed to other efforts at Sandia, such as global climate research with unmanned aerial vehicles, automotive instrumentation, advanced weapon concepts, and sensing for homeland security applications.



Computer-generated model of a reentry vehicle instrumentation package

Learn more at
http://www.sandia.gov

For more information contact
Sandia National Laboratories
Art Hull at (925) 294-3105
alhull@sandia.gov
Jim Lund at (925) 294-3871
jlund@sandia.gov
or Paul Yoon at (925) 294-1451
pyyoon@sandia.gov